

## flour

Flour is a food prepared by grinding and sieving grains, primarily WHEAT. Wheat flour is particularly suitable for use as an ingredient in the preparation of baked products. When it is mixed with liquid in the correct proportions, its major protein components (collectively known as gluten) form an elastic network that is capable of holding leavening gases and that will set to a rather firm spongy structure when heated in an oven. Other grains—among them, barley, buckwheat, corn, rice, and rye—are also ground into flour and are often mixed with wheat flour in making certain types of bread. Almost all grain flours are made using the processes described here for wheat flour.

Wheat is divided into hard wheats, whose flours yield doughs that are elastic and have excellent gas-holding or expansion properties, and soft wheat, whose flours are used for cakes, cookies, piecrusts, and similar products where a high volume is not essential and a tender or crumbly texture is desired. Hard wheats have a higher protein content than soft wheats. All-purpose flour is usually made from a combination of hard and soft wheats and is used to make most home-baked products.

The milling process by which flour is made separates the wheat endosperm (the starchy interior portion of the kernel) from the BRAN layers and the wheat germ and then reduces the endosperm chunks to a fine powder. In conventional modern milling processes, the wheat kernels and their products are passed between several pairs of rotating steel cylinders and the ground material is sifted, thus separating particles of different sizes. The first few sets of roll mills break open the seed coat and strip out the friable endosperm. Subsequent sets of rolls grind the particles finer and perform other essential functions such as flattening the germ, thereby facilitating its separation from the endosperm particles. After each stage of the grinding process, stacks of screens with different mesh sizes separate the ground material into several streams. These streams may be further processed by grinding, or they may be drawn off for feedstuffs or combined to yield flours with different properties.

By combining properly selected streams, the miller can make flours of widely varying quality from the same wheat. Ordinarily, about 70 percent of the kernel emerges from the process as flour of some sort. Mill streams consisting of the bran and germ, together with the endosperm particles that cannot be separated from them, are usually mixed together and sold as ingredients for animal feed.

Whole wheat flour is prepared in much the same way as white flour, except that the ground bran, germ, and endosperm are ultimately combined to produce a material having much the same composition as the original grain. Whole wheat flour is darker, coarser, and stronger in flavor than white flour, and the BREAD made from it is tougher and denser. This flour also becomes rancid more quickly during storage. Most whole wheat breads contain substantial amounts of white flour for improving baking performance.

Like most foods, flour does not provide a complete or well-balanced supply of all essential nutrients. Other ingredients used in making bread, especially milk and yeast, provide some additional amino acids, vitamins, and minerals. Enriched flour contains extra amounts of thiamin, riboflavin, niacin, and iron added by the miller. It may also contain additional calcium or wheat germ.

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Bibliography: Steen, H., *Flour Milling in America* (1963; repr. 1973).